JAVELIN ANTITANK MISSILE

Army ACAT ID Program

Total Number of Systems:	4,348 CLUs 28,453 missiles
Total Program Cost (TY$):	$3618M
Average CLU Cost (TY$):	$162K
Average Missile Cost (TY$):	$78K
Full-rate production:	3QFY97

Prime Contractor

Texas Instruments/Lockheed Martin Joint Venture

SYSTEM DESCRIPTION & CONTRIBUTION TO JOINT VISION 2010

The Javelin is a manportable, fire-and-forget, anti-tank missile employed by dismounted infantry to defeat current and future threat armored combat vehicles. It is replacing the Dragon system in the Army and the Marine Corps.

The Javelin consists of a missile in a disposable launch tube and a reusable Command Launch Unit (CLU), with a trigger mechanism and day/night-sighting device for surveillance, target acquisition, and built-in test capabilities. The missile locks on to the target before launch using an infrared focal plane array and on-board processing, which also maintains target track and guides the missile to the target after launch. A full-up system weighs 49.1 pounds. The Javelin Training System consists of three devices, each fulfilling a specific role. The Missile Simulation Round is used to familiarize the gunner with the physical characteristics of the Javelin. The Basic Skills Trainer (BST) is used to develop the basic tactical and technical gunnery skills to operate the Javelin. The Field Tactical Trainer (FTT) is

used to refine the gunner's ability and enable the gunner to participate in both range training and force-on-force exercises. The two FTT configurations are designated FTT(Range) and FTT(Force-On-Force (FOF)).

The Javelin contributes to ***Joint Vision 2010*** as a tactical ***precision engagement*** system that enhances the Army's ***dominant maneuver*** capabilities in the ground battle.

BACKGROUND INFORMATION

A January 1978 Anti-armor Mission Need Statement identified the deficiencies of the Army's current manportable anti-armor weapon—the Dragon. The Joint Service Operational Requirements Document for the Javelin was approved in 1986 and amended in 1988. The contract for Javelin EMD was awarded in 1989. IOT&E, which was completed in December 1993, resulted in the conclusion that Javelin was effective, but required further assessment for suitability. LRIP was approved by the DAB in July 1994.

LFT&E started in November 1995 and was completed in October 1996. It consisted of three progressive phases that challenged the Javelin against current and emerging tank threats. Phase A was comprised of a large series of shots to determine the missile's capability to penetrate rolled homogeneous armor and more fully understand its ability to create behind-armor debris immediately upon penetration. Phase B tested the missile's ability to penetrate shotline targets representing an advanced threat tank and Phase C constituted the full-scale, full-up LFT&E phase.

Follow-on testing in the form of a Limited User Test (LUT) began in April 1996. The LUT consisted of three events: (1) Situational Tactical Exercises, which were limited force-on-force engagements; (2) Live Fire Exercises, which consisted of six explosive warhead shots; and (3) Multiple Integrated Laser Engagement System Pairing and Operational Lock-on Trials, which compared the ability of the Javelin field tactical trainer in replicating the tactical system. Missile reliability problems caused a temporary halt in the firing program. Three failed-launch situations occurred early on, requiring fixes before the Army could complete the LUT in June 1996.

As a side note, two operational tests were conducted with DOT&E encouragement: (1) a LUT (described in the previous paragraph) that resulted in a number of system improvements, especially in reliability; and (2) a Confirmatory Test that demonstrated performance of the enhanced producibility program (EPP) version of the missile early enough to influence the Milestone III decision and reduce the scope of follow-on tests.

There are several Javelin-enhanced producibility program changes that are being incorporated into the system to enhance producibility and reduce cost. Only LRIP versions of the Javelin CLU and missile have been fielded to date, but ultimately LRIP and EPP versions of both the CLU and missile will be fielded. The DOT&E B-LRIP Report (April 1997) supported the Javelin Milestone III full-rate production decision made on May 13, 1997.

Several reliability and availability performance thresholds for the Javelin CLU, missile and training devices were defined relative to System Maturity; i.e., Milestone III plus three years (May 2000). Testing to address these requirements, primarily developmental in nature, is ongoing. Related data are also being extracted from gunner training periods and dedicated training exercises.

Failures observed during lot acceptance testing in FY99 caused the Army to reject the first lot of full-rate production missiles (FRP 1 LOT 1–500 missiles) due to a marginal design of a subcomponent provided by a new vendor. The situation is under review, with resolution expected by April 2000.

Future testing will be required to evaluate the Javelin Enhanced Tandem Integration (JETI), a hardware modification, and the Lethality Improvement Tracker Enhancement (LITE), a software modification. JETI modifies the manner in which the existing precursor and main charge warheads are mounted within the missile. However, the warheads themselves are unchanged from earlier production. This differs from another option under consideration, which would have replaced the main charge warhead with the Advanced Main Charge Warhead–Full Caliber (AMCW-FC). In early FY99, the PM chose the JETI option over the AMCW-FC because it provided much of the AMCW-FC's expected penetration improvement, but with more consistency at less risk and lower cost. In addition, flight testing against threat Automated Protection Systems (aboard armor vehicles and designed to detect and destroy incoming missiles) is pending until such systems are available for testing. Regarding LITE, the software issues have not been resolved. A recent move by industry caused several software experts to leave the program. Modified software will be less difficult to cut into production once solutions are developed. However, under the present set of circumstances, it is difficult to say when LITE will be cut into production.

TEST & EVALUATION ACTIVITY

There are two requirements for missile reliability that remain under test. At Milestone III, missile reliability was to be 0.82 and at System Maturity (Milestone III plus three years) 0.92. The ongoing data collection to support the Javelin System Maturity Evaluation includes: (1) results from EPP production reliability, verification, maintenance, and production validation testing; (2) LRIP missile quality verification and stockpile reliability program testing; and (3) field use and demonstrations by units to which the LRIP system has been issued. System Maturity is to be assessed in May 2000.

After the PM selected the JETI option over the AMCW-FC, the Army adopted the live fire Integrated Product Team (IPT) recommendation that since the JETI changes would not significantly affect Javelin's lethality, full-up system-level live fire testing was not warranted. The Army completed the first two phases of a three-phase IPT-developed JETI T&E program to assess the missile's ability to defeat current and projected threat armored vehicles. The testing included a variety of static and dynamic firings of the main charge and the complete tandem warhead against steel armor sections, range targets that represented specific threat targets, and shotline targets that replicated specific impact points on the threat targets of interest. The final phase of testing will be three or four firings of tactical missiles against operational tank targets during the LITE test program. As a side note, if the Army decides to implement the AMCW-FC at a later date, full-up system-level testing would be required.

Recent failures on a FRP 1/LOT 1 acceptance test surfaced a marginal design problem with a subcomponent provided by a new vendor and resulted in rejection of the entire LOT (500 missiles). Upon investigation, the one failure of six parts tested during the qualification test for this particular part in question was originally assessed as "failed due to a test anomaly." Based on what is known at this time, the failure on the qualification test was the initial indication of a faulty design of the subcomponent. Qualification testing for a new design is scheduled to be complete by 2QFY00.

TEST & EVALUATION ASSESSMENT

The Javelin system has been adequately tested in accordance with the OSD-approved TEMP, and has been declared operationally effective, suitable and lethal (DOT&E B-LRIP Report, April 1997). Unresolved suitability issues concern only those specific reliability and availability requirements prescribed for System Maturity (Milestone III plus 3 years). System component reliability and availability are the primary factors of interest at System Maturity. Reliability is defined as the fraction of successes in total missile firings, and for all other (reusable) components, Mean Time (in hours) Between Operational Mission Failure (MTBOMF). Operational availability is the probability that a system is operating or will operate when called upon for use at a random time. These System Maturity requirements include:

- Training device reliability [BST, FTT(Range) and FTT(FOF)].
- LRIP CLU reliability and availability.
- EPP CLU reliability and availability.
- Missile round reliability.

Based on our analysis of the current demonstrated values of the system maturity parameters as compared to the requirements at system maturity, it appears that CLU and BST meet their system maturity requirements. The missile reliability is uncertain with point estimates around the requirement. There is insufficient information about EPP/FRP rounds to make a credible assessment at this time. The FTT(Range) meets its requirement. The FTT(FOF) does not. The data are essentially the same for the two configurations, but FTT(Range), by the addition of the Instructor Station (which rarely fails), has a requirement of only 50 hours MTBOMF vice 67 for the FTT(FOF).

Concerning missile reliability, continued observation and analysis is warranted. Our concern stems from the following: (1) the program had trouble maintaining reliability while transitioning from Engineering and Manufacturing Development missile production to Low Rate Initial Production; (2) the reliability of EPP missiles to date is assessed as "unresolved" because, while the point estimate is at the requirement, so few missiles have been fired that confidence that the requirement has been met or exceeded is less than 50 percent; and (3) the resolution of the FRP 1/LOT 1 faulty subcomponent design situation. We intend to continue monitoring missile reliability in the full-rate production phase before assessing whether the missile reliability System Maturity requirement has been fully met. If it is found after assessment at System Maturity, in May 2000, that Javelin meets its requirements, System Maturity Follow-On Test and Evaluation for reliability will not be required.

Two phases of JETI warhead testing have been completed. The JETI warhead has performed as expected, and is as lethal as the existing warhead, albeit with less variability. JETI is expected to be cut into production as part of Full-Rate Production Lot #3 in FY00.

LESSONS LEARNED

The Javelin program offers a good example of a well-executed lethality product improvement. First, the Javelin Program Office developed a simple but effective means to increase Javelin's lethality without undue risk or significant cost increase. Then the Program Office conducted a comparative test-

based assessment of the simpler alternative with a contractor-developed alternative warhead to determine the preferable option and then shared the information with the LFT&E IPT. Finally, the selected alternative is now undergoing an IPT-developed T&E program to compare the performance of the improved Javelin warhead with what had been previously reported to Congress.